Original Research Article

**Effect of Phosphorus and Zinc Sulphate on Yield Attributes and Quality of Guava (Psidium guajava L.) cv. Gwalior 27**

Dinesh Dhakar*, A. K. Barholia and Rajesh Jatav

R.V.S.K.V.V., Department of Horticulture, College of Agriculture, Gwalior-474002, M.P., India

*Corresponding author

**ABSTRACT**

An experiment was conducted during 2013 to find out the effect of phosphorus, zinc sulphate and their combined effect on yield and quality of Guava (Psidium guajava L.) cv. G-27. The experiment was laid out in Randomized Block Design (RBD) with thirteen number of treatments replicated thrice in well established 15 years old plant of guava. There were four levels of phosphorus i.e., 300 g, 400 g, 500 g and 600 g., three levels of spray of zinc sulphate i.e., 0.25%, 0.50% and 0.75%, while the control plants received no fertilizer and no spray. The study revealed that 600 g phosphorus per plant, spray of 0.75% zinc sulphate (P₃×Zn₃), followed by P₂×Zn₃ (P₂O₅ 500 g/ plant & ZnSO₄ @ 0.75 %) were found to be the best treatments for almost all yield and quality parameters of guava plant, for getting maximum yield with quality fruits in northern Madhya Pradesh.

**Keywords**

Guava, Phosphorus, Zinc sulphate, Yield, Quality.

**Introduction**

Guava (Psidium guajava L.), the apple of the tropics, which belongs to the family Myrtaceae, is an evergreen tree is one of the major fruit crops of India and is extensively grown in wide area of tropical, sub-tropical and some parts of arid regions of India because of its low cost of cultivation, more tolerant to drought and semiarid conditions as well as salinity problems. It has wide adaptability to varying soil and climatic conditions. It is a cheap and very rich source of vitamin-C, carbohydrate, iron, fat and contains a fair amount of calcium and phosphorus. Guava fruits are also used for preparation of salad, chutney, jam, jelly, nectar etc. These qualities make guava an important and one of the most popular fruits of India. India is the leading producer of guava in the world.

Gwalior is an important region in Madhya Pradesh, where guava is widely grown and several guava orchards are found in and around the Gwalior district. However, yield and quality of the guava tree is influenced by a large number of factors. One of the important factors is inadequate supply of plant nutrients. Nutrient requirement of guava vary with varieties and agroclimatic conditions. It gives good response to manuring and fertilization. Out of various major nutrients, phosphorus plays extremely important role in guava cultivation for optimum yield and performance. Uses of micronutrients also play an important role to avoid hidden nutrient hunger. Zinc is one of the important micronutrients required for flowering, fruiting, yield and quality of fruits. Gwalior-27 is a popular variety in
northern Madhya Pradesh but nutritional requirement of this variety has not been standardized so far.

**Materials and Methods**

The experiment was conducted at orchard of Department of horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior during the year 2013-14. The experiment was laid out in randomized block design with thirteen treatments including control replicated three times. The phosphorus was applied as basal dose prior to start of flowering in end of June, while single foliar spray of zinc sulphate was done after fruitset. The details of treatments are T₀ (Control), T₁ (Phosphorus @ 300 g + Zinc sulphate @ 0.25 %), T₂ (Phosphorus @ 300 g + Zinc sulphate @ 0.50 %), T₃ (Phosphorus @ 300 g + Zinc sulphate @ 0.75 %), T₄ (Phosphorus @ 400 g + Zinc sulphate @ 0.25 %), T₅ (Phosphorus @ 400 g + Zinc sulphate @ 0.50 %), T₆ (Phosphorus @ 400 g + Zinc sulphate @ 0.75 %), T₇ (Phosphorus @ 500 g + Zinc sulphate @ 0.25 %), T₈ (Phosphorus @ 500 g + Zinc sulphate @ 0.50 %), T₉ (Phosphorus @ 500 g + Zinc sulphate @ 0.75 %) and T₁₀ (Phosphorus @ 600 g + Zinc sulphate @ 0.25 %), T₁₁ (Phosphorus @ 600 g + Zinc sulphate @ 0.50 %), T₁₂ (Phosphorus @ 600 g + Zinc sulphate @ 0.75 %). The various observations recorded during the investigation were number of fruits per plant, weight of fruit (g), yield of fruit per plant (kg), yield per hectare (q), total soluble solid (°Brix), titrable acidity (%) and ascorbic acid (mg/100g).

**Results and Discussion**

The data pertaining to various yield and quality parameters of the guava plant viz. number of fruits per plant, weight of fruit (g), yield of fruit per plant (kg), yield per hectare (q), total soluble solid (°Brix), titrable acidity (%) and ascorbic acid (mg/100g) are given in [Table 1 and 2].

**Yield attributing characters**

**Number of fruits per plant**

The perusal of data presented in table 1, revealed that the number of fruits per plant was significantly affected by the application of phosphorus over the other level of treatments. The mean maximum number of fruits per plant (205.11) was recorded under P₄ P₂O₅ 600 g/ plant, which was at par with the treatment P₂O₅ 500 g/ plant (204), while the minimum number of fruits per plant (194.66) was recorded under the treatment P₂O₅ 300 g/ plant respectively. The number of fruits per plant was significantly affected due to the spray of zinc sulphate over the other level of treatments. The mean maximum number of fruits per plant (208.33) was recorded under Zn₃ (ZnSO₄ @ 0.75 %), which was significantly superior to the other levels of ZnSO₄, respectively, while the minimum number of fruits per plant (189.00) was recorded under the treatment ZnSo₄ @ 0.25 %. The interaction effect of phosphorus and zinc sulphate on number of fruits per plant was significantly influenced by the different combinations. (Table 2). The maximum number of fruits per plant (211.00) was recorded under treatment combinations P₄ x Zn₃ (P₂O₅ @ 600 g/ plant & ZnSO₄ @ 0.75 %), while the minimum number of fruits per plant (176.67) under the treatment combination P₁ x Zn₁ (P2O5 @ 300 g/ plant & ZnSO₄ @ 0.25 %) respectively.

**Weight of fruit (g)**

The perusal of data presented in table 1 revealed that the weight of fruit was
significantly increased by the application of phosphorus over the other level of treatments. The mean maximum weight of fruit (198.46 g) was recorded under P₂O₅ 600 g/ plant, the treatment P₃ and P₂ was also showed good result (195.60 and 192.81 g), while the minimum weight of fruit (188.13 g) was recorded under the treatment P₂O₅ 300 g/ plant respectively. The weight of fruit was significantly affected due to the spray of zinc sulphate over the other level of treatments. The mean maximum weight of fruit (209.06 g) was recorded under Zn₃ (ZnSO₄ @ 0.75 %), which was significantly superior to the other levels of ZnSO₄, while the minimum weight of fruit (177.31 g) was recorded under the treatment ZnSO₄ @ 0.25 %. The interaction effect of soil application of phosphorus and foliar application zinc sulphate on weight of fruit was significantly influenced by the different combinations. (Table 2). The maximum weight of fruit (211.66 g) was recorded under treatment combinations P₄ x Zn₃ (P₂O₅ @ 600 g/ plant & ZnSO₄ @ 0.75 %), which was at par with the treatment combinations P₃ x Zn₃ (P₂O₅ @ 500 g/ plant & ZnSO₄ @ 0.75 %) and P₂ x Zn₃ (P₂O₅ @ 400 g/ plant & ZnSO₄ @ 0.75 %), (209.70 And 209.32 g, respectively), while the minimum weight of fruit (168.12 g) was recorded under the treatment combination P₁ x Zn₁ (P₂O₅ @ 300 g/ plant & ZnSO₄ @ 0.25 %).

**Yield of fruit per plant (kg)**

The perusal of data presented in table 1, revealed that the yield of fruits per plant was significantly increased by the application of phosphorus over the other level of treatments. The mean maximum yield of fruits per plant (40.77 kg) was recorded under P₂O₅ 600 g/ plant which was at par with the treatment P₃ (P₂O₅ 500 g/ plant) (39.97 kg), while the minimum yield of fruits per plant (36.81 kg) was recorded under the treatment P₂O₅ 300 g/ plant, respectively. The yield of fruits per plant was significantly affected due to the spray of zinc sulphate over the other level treatment. The mean maximum yield of fruits per plant (43.56 kg) was recorded under Zn₃ (ZnSO₄ @ 0.75 %), which was significantly superior to the other levels of ZnSO₄, respectively. The treatment Zn₂ (ZnSO₄ @ 0.50 %) was showed better result (39.74 kg), while the minimum yield of fruits per plant (33.57 kg) was recorded under the treatment ZnSO₄ @ 0.25 %. The interaction effect of phosphorus and zinc sulphate on yield of fruits per plant was significantly influenced by the different combinations. (Table 2). The maximum yield of fruits per plant (44.69 kg) was recorded under treatment combinations P₄ x Zn₃ (P₂O₅ @ 600 g/ plant & ZnSO₄ @ 0.75 %), which was at par with the treatment combinations P₃ x Zn₃ (P₂O₅ @ 500 g/ plant & ZnSO₄ @ 0.75 %) and P₂ x Zn₃ (P₂O₅ @ 400 g/ plant & ZnSO₄ @ 0.75 %) (44.04 and 43.33 kg, respectively), while the minimum yield of fruits per plant (29.70 kg) was obtained under the treatment combination P₁ x Zn₁ (P₂O₅ @ 300 g/ plant & ZnSO₄ @ 0.25 %), respectively.

**Yield per hectare (q)**

The perusal of data presented in table 1, revealed that the yield per hectare was significantly influenced by the application of phosphorus over the other level of treatments. The mean maximum yield per hectare (113.33 q) was recorded under P₄ (P₂O₅ 600 g/ plant). The treatment P₃ also showed better result (111.10 q), while the minimum yield per hectare (102.32 q) was recorded under the treatment P₂O₅ 300 g/ plant, respectively. The yield per hectare was significantly affected due to the spray of zinc sulphate over the other treatments. The mean maximum yield per hectare (121.09 q) was recorded under Zn₃ (ZnSO₄ @ 0.75 %),
which was significantly superior to the other levels of ZnSO₄, while the minimum yield per hectare (93.31 q) was recorded under the treatment ZnSO₄ @ 0.25 %. The interaction effect of phosphorus and zinc sulphate on yield per hectare was significantly influenced by the different combinations. (Table 2).

**Table 1. Effect of phosphorus and zinc sulphate on yield and quality parameters of guava**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Number of fruits per plant</th>
<th>Weight of fruit (g)</th>
<th>Yield of fruit per plant (kg)</th>
<th>Yield per hectare (q)</th>
<th>Total soluble solid (°Brix)</th>
<th>Titrable acidity (%)</th>
<th>Ascorbic acid (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁ 300g/plant</td>
<td>194.66</td>
<td>188.13</td>
<td>36.81</td>
<td>102.32</td>
<td>9.61</td>
<td>0.69</td>
<td>148.61</td>
</tr>
<tr>
<td>P₂ 400g/plant</td>
<td>197.88</td>
<td>192.81</td>
<td>38.28</td>
<td>106.43</td>
<td>10.15</td>
<td>0.69</td>
<td>150.37</td>
</tr>
<tr>
<td>P₃ 500g/plant</td>
<td>204.00</td>
<td>195.60</td>
<td>39.97</td>
<td>111.10</td>
<td>10.45</td>
<td>0.68</td>
<td>152.16</td>
</tr>
<tr>
<td>P₄ 600g/plant</td>
<td>205.11</td>
<td>198.46</td>
<td>40.77</td>
<td>113.33</td>
<td>10.54</td>
<td>0.68</td>
<td>152.60</td>
</tr>
<tr>
<td>S.Em.±</td>
<td>0.420</td>
<td>0.666</td>
<td>0.157</td>
<td>0.437</td>
<td>0.310</td>
<td>0.012</td>
<td>2.096</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>1.22</td>
<td>1.937</td>
<td>0.457</td>
<td>1.270</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>ZnSO₄</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z₁ 0.25%/plant</td>
<td>189.00</td>
<td>177.31</td>
<td>33.57</td>
<td>93.31</td>
<td>9.65</td>
<td>0.69</td>
<td>145.21</td>
</tr>
<tr>
<td>Z₂ 0.50% plant</td>
<td>203.91</td>
<td>194.88</td>
<td>39.74</td>
<td>110.49</td>
<td>10.17</td>
<td>0.69</td>
<td>150.76</td>
</tr>
<tr>
<td>Z₃ 0.75% plant</td>
<td>208.33</td>
<td>209.06</td>
<td>43.56</td>
<td>121.09</td>
<td>10.74</td>
<td>0.68</td>
<td>156.85</td>
</tr>
<tr>
<td>S.Em.±</td>
<td>0.363</td>
<td>0.577</td>
<td>0.136</td>
<td>0.378</td>
<td>0.268</td>
<td>0.010</td>
<td>1.815</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>1.058</td>
<td>1.678</td>
<td>0.396</td>
<td>1.099</td>
<td>0.771</td>
<td>NS</td>
<td>5.277</td>
</tr>
</tbody>
</table>

**Table 2. Interaction effect of phosphorus and zinc sulphate on yield and quality parameters of guava**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Number of fruits per plant</th>
<th>Weight of fruit (g)</th>
<th>Yield of fruit per plant (kg)</th>
<th>Yield per hectare (q)</th>
<th>Total soluble solid (°Brix)</th>
<th>Titrable acidity (%)</th>
<th>Ascorbic acid (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction (PXZ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T₁(1) P₁Z₁</td>
<td>176.67</td>
<td>168.12</td>
<td>29.70</td>
<td>82.57</td>
<td>8.50</td>
<td>0.71</td>
<td>144.54</td>
</tr>
<tr>
<td>T₁(2) P₁Z₂</td>
<td>202.66</td>
<td>190.20</td>
<td>38.55</td>
<td>107.16</td>
<td>9.92</td>
<td>0.70</td>
<td>146.64</td>
</tr>
<tr>
<td>T₁(3) P₁Z₃</td>
<td>204.66</td>
<td>206.06</td>
<td>42.17</td>
<td>117.25</td>
<td>10.42</td>
<td>0.67</td>
<td>154.66</td>
</tr>
<tr>
<td>T₁(4) P₂Z₁</td>
<td>185</td>
<td>175.00</td>
<td>32.37</td>
<td>90.00</td>
<td>9.91</td>
<td>0.69</td>
<td>144.81</td>
</tr>
<tr>
<td>T₁(5) P₂Z₂</td>
<td>201.66</td>
<td>194.12</td>
<td>39.15</td>
<td>108.83</td>
<td>10.11</td>
<td>0.70</td>
<td>149.64</td>
</tr>
<tr>
<td>T₁(6) P₂Z₃</td>
<td>207.00</td>
<td>209.32</td>
<td>43.33</td>
<td>120.45</td>
<td>10.43</td>
<td>0.68</td>
<td>156.66</td>
</tr>
<tr>
<td>T₁(7) P₃Z₁</td>
<td>196</td>
<td>182.03</td>
<td>35.68</td>
<td>99.18</td>
<td>10.08</td>
<td>0.68</td>
<td>145.22</td>
</tr>
<tr>
<td>T₁(8) P₃Z₂</td>
<td>206.00</td>
<td>195.07</td>
<td>40.18</td>
<td>111.71</td>
<td>10.27</td>
<td>0.68</td>
<td>153.73</td>
</tr>
<tr>
<td>T₁(9) P₃Z₃</td>
<td>210</td>
<td>209.70</td>
<td>44.04</td>
<td>122.42</td>
<td>11.01</td>
<td>0.69</td>
<td>157.54</td>
</tr>
<tr>
<td>T₁(10) P₄Z₁</td>
<td>198.33</td>
<td>184.08</td>
<td>36.51</td>
<td>101.50</td>
<td>10.12</td>
<td>0.69</td>
<td>146.26</td>
</tr>
<tr>
<td>T₁(11) P₄Z₂</td>
<td>205.33</td>
<td>200.16</td>
<td>41.10</td>
<td>114.26</td>
<td>10.38</td>
<td>0.67</td>
<td>153.02</td>
</tr>
<tr>
<td>T₁(12) P₄Z₃</td>
<td>211.66</td>
<td>211.15</td>
<td>44.69</td>
<td>124.25</td>
<td>11.11</td>
<td>0.67</td>
<td>158.54</td>
</tr>
<tr>
<td>S.Em.±</td>
<td>0.727</td>
<td>1.154</td>
<td>0.272</td>
<td>0.757</td>
<td>0.536</td>
<td>0.021</td>
<td>3.631</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>2.116</td>
<td>3.356</td>
<td>0.791</td>
<td>2.201</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>
The maximum yield per hectare (124.25 q) was recorded under treatment combinations P₄ x Zn₃ (P₂O₅ @ 600 g/ plant & ZnSO₄ @ 0.75 %), which was at par with the treatment combination P₃ x Zn₃ (P₂O₅ @ 500 g/ plant & ZnSO₄ @ 0.75 %) 122.42 q respectively, while the minimum yield per hectare (82.57 q) under the treatment combination P₁ x Zn₁ (P₂O₅ @ 300 g/ plant & ZnSO₄ @ 0.25 %).

**Quality parameters**

**Total soluble solid (°Brix)**

The perusal of data presented in table 1, revealed that the TSS was not significantly affected by the application of phosphorus over the other level of treatments. The mean maximum TSS (10.74 °Brix) was recorded under P₂O₅ 600 g/plant, while the minimum TSS (9.61 °Brix) was recorded under the treatment P₂O₅ 300 g/plant respectively. The TSS was significantly affected due to the spray of zinc sulphate over the other treatment. The mean maximum TSS (10.54 °Brix) was recorded under Zn₂ (ZnSO₄ @ 0.50 %) and Zn₁ (ZnSO₄ @ 0.25 %), while the minimum TSS (9.65 °Brix) was recorded under the treatment ZnSO₄ @ 0.75 % respectively. The interaction effect of phosphorus and zinc sulphate on TSS was not significantly influenced by the different combinations. (Table 2). The maximum TSS (11.11 °Brix) was recorded under treatment combinations P₄ x Zn₃ (P₂O₅ @ 300 g/plant & ZnSO₄ @ 0.75 %), while the minimum TSS (8.50 °Brix) under the treatment combination P₁ x Zn₁ (P₂O₅ @ 300 g/plant & ZnSO₄ @ 0.25 %), respectively.

**Titrable acidity (%)**

The perusal of data presented in table 1, revealed that the titrable acidity was not significantly affected by the application of phosphorus over the other level of treatment. The mean maximum titrable acidity (0.69 %) was recorded under P₂O₅ 400 g/plant and P₂O₅ 300 g/plant while the minimum titrable acidity (0.68 %) was recorded under the treatment P₂O₅ 600 g/plant and P₂O₅ 500 g/plant, respectively. The titrable acidity was not significantly affected due to the spray of zinc sulphate over the other treatment. The mean maximum titrable acidity (0.69 %) was recorded under Zn₂ (ZnSO₄ @ 0.50 %) and Zn₁ (ZnSO₄ @ 0.25 %), while the minimum titrable acidity (0.68 %) was recorded under the treatment ZnSO₄ @ 0.75 %, respectively. The interaction effect of phosphorus and zinc sulphate on titrable acidity was not significantly influenced by the different combinations. (Table 2). The minimum titrable acidity (0.67 %) was recorded under treatment combinations P₁ x Zn₁ (P₂O₅ @ 300 g/plant & ZnSO₄ @ 0.25 %), P₄ x Zn₂ (P₂O₅ @ 600 g/plant & ZnSO₄ @ 0.50 %) and P₄ x Zn₁ (P₂O₅ @ 600 g/plant & ZnSO₄ @ 0.25 %), respectively.

**Ascorbic acid (mg/100g)**

The data presented in table 1, revealed that the ascorbic acid was not significantly increased by the application of phosphorus over the other level of treatments. The mean maximum ascorbic acid (152.60 mg/100 g) was recorded under P₂O₅ 600 g/plant, while the minimum ascorbic acid (148.61 mg/100 g) was recorded under the treatment P₂O₅ 300 g/plant respectively. The ascorbic acid content was significantly affected due to the spray of zinc sulphate over the other treatments. The mean maximum ascorbic acid (156.85 mg/100 g) was recorded under Zn₃ (ZnSO₄ @ 0.75 %), while the minimum ascorbic acid (145.21 mg/100 g) was recorded under the treatment ZnSO₄ @ 0.25 % respectively. The interaction effect of
phosphorus and zinc sulphate on ascorbic acid was not significantly influenced by the different combinations. (Table 2). The maximum ascorbic acid acidity (158.54 mg/100 g) was recorded under treatment combinations P_4 x Zn_3 (P_2O_5 @ 600 g/plant) while the minimum ascorbic acid (144.54 mg/100 g) under the treatment combination P_1 x Zn_1 (P_2O_5 @ 300 g/plant & ZnSO_4 @ 0.25 %), respectively.

**Effect of Phosphorus**

**Yield attributing parameters**

The data pertaining various yield attributing parameters of the guava plant viz; number of fruits per plant, weight per fruit, yield of fruits per plant (kg) and yield per hectare were significantly improved by the soil application of phosphorus.

The maximum number of fruits per plant (205.11), weight per fruit (198.46 g), yield per plant (40.77 kg) and yield per hectare (113.33 q) were recorded under the treatment P_4 (P_2O_5 600 g/plant), which were significantly superior to other levels of P_3 (P_2O_5 500 g/plant), P_2 (P_2O_5 400 g/plant), P_1 (P_2O_5 300 g/plant), while, the minimum number of fruits per plant (194.66), weight per fruit (188.13 g), yield per plant (36.81 kg) and yield per hectare (102.3 q) noted under P_1 (P_2O_5 300 g/plant). These findings are in agreement with those reported by Chaplin and Westood, (1980).

**Quality characters**

The chemical parameters of guava fruits were not significantly influenced by the soil application of phosphorus. The maximum TSS (10.54 °Brix), was recorded under P_4 (P_2O_5 600 g/plant) and minimum P_1 (P_2O_5 300 g/plant), titrable acidity (0.69 %) were recorded under the treatment P_2 (P_2O_5 400 g/plant) and P_1 (P_2O_5 300 g/plant) and ascorbic acid content (152.60 mg/100 g), whereas, minimum TSS (9.61 °Brix) was recorded under P_1 (P_2O_5 300 g/plant). The minimum titrable acidity (0.68 %) were recorded under the treatment P_3 (P_2O_5 500 g/plant) and P_4 (P_2O_5 600 g/plant). These findings are in agreement with those reported by Shuman, (1998) and Van den Driessche, (2002).

**Effect of zinc sulphate**

**Yield attributing parameters**

The data pertaining to various yield attributing parameters of the guava plant viz; fruit length, fruit width, number of fruits per plant, weight of fruit, yield of fruit per plant and yield per hectare were significantly increased by the various sprays of zinc sulphate. The increased fruit length (6.90 cm), fruit width (6.89 cm) and maximum number of fruits per plant (208.33), weight of fruit (209.06 g), yield per plant (43.56 kg) and yield per hectare (121.09 q) were recorded under the treatment Zn_3 (ZnSO_4 @ 0.75 %), which were significantly superior to the other levels of Zn (ZnSO_4 @ 0.25 %, ZnSO_4 @ 0.50%) whereas, the minimum number of fruits per plant (189.00), weight of fruit (177.31 g), yield per plant (33.57 kg) and yield per hectare (93.31q) were recorded under Zn_1 (ZnSO_4 @ 0.25 %). The increase in fruit yield due to the increased growth and yield parameters may be due to the increased auxin production. Zinc acts as catalyst in the oxidation and reduction processes and is also of great importance in the sugar metabolism which might have improved the physical characters of guava fruit and thus increased the yield per tree. Heavier fruits under zinc treatment might be due to the high level of auxin in the various parts of the fruit maintained by zinc application. The role of Zn in production of
auxins is well known. The increase in the fruit weight by zinc spray was due to the significant increase in the fruit width and length. The increase in the yield under the effect of zinc sprays might be due to the fact that zinc is universally claimed to be an essential micro nutrient and it is considered indispensable for the growth of all organisms (Arora & Singh, 1970 b). Mansour and Sied (1981) reported that foliar spray of zinc at 0.5 and 1.0 per cent concentrations increased fruit set, reduced pre-harvest abscission and increased yield; at picking time fruit characters were good. Effect of zinc spray on yield have earlier been also reported by Mansour and Sied (1981), Pandey et al., (1988), Sharma et al., (1991), Dahiya et al., (1993), Kundu and Mitra (1999), Balakrishnan (2000), Balakrishnan (2001), Bhatia et al., (2001), Meena et al., (2005) and Tiwari and Shant (2010) in guava.

Quality characters

The quality parameters of guava fruits were significantly improved by the spray of zinc sulphate. The maximum TSS (10.74 °Brix) was recorded under treatment Zn3 (ZnSO4 @ 0.75%), which were significantly superior to the other levels of Zn (ZnSO4 @ 0.25%, ZnSO4 @ 0.50%), while minimum TSS (9.65 °Brix). The maximum titrable acidity (0.69 %) was recorded under the treatments Zn (ZnSO4 @ 0.25% & ZnSO4 @ 0.50%), while the minimum was recorded under the treatment Zn3 (ZnSO4 @ 0.75%). The maximum ascorbic acid mg/100 g (156.85 g) was recorded under the treatments Zn3 (ZnSO4 @ 0.75 %), while the minimum was recorded under the treatment Zn1 (ZnSO4 @ 0.25 %). The enhanced physical growth parameters of guava fruits may be due to the fact that Zn acts as catalyst in the oxidation and reduction process and is also of great importance in sugar metabolism. The acid under the influence of zinc might have either been fastly converted into sugars and their derivatives by the reactions, involving the reversal of glycolytic pathway or be used in respiration or both. Decrease in acidity due to zinc spray is in agreement with the observations of Rajput and Chand (1976). Singh and Chhonkar (1983) recorded significant increase in total soluble solids, reducing sugar and ascorbic acid content in ‘Mrig-bahar’ guava pulp with foliar spray of 0.4 per cent zinc sulphate solution over control. Increase in sugar by zinc might be due to the active enzymatic reaction like transformation of carbohydrates, activity of hexokinase and formation of cellulose. This present investigation finds support from Pandey et al., (1988) and Prasad et al., (2005) in guava.

Interaction effect of phosphorus and zinc sulphate

Yield attributing Parameters

The combined application of phosphorus and zinc sulphate showed great improvement in yield attributing characters of guava. The maximum number of fruit (211.66) was obtained under P4 X Zn3 (P2O5 600 g/ plant & ZnSO4 @ 0.75 %) and minimum number of fruit (176.67) obtained with P1 X Zn1 (P2O5 300 g/ plant & ZnSO4 @ 0.25 %). The higher weight per fruit (211.15 g), yield per plant (44.69 kg) and yield per hectare (124.25 q) was noted under P4 X Zn3 (P2O5 600 g/ plant & ZnSO4 @ 0.75 %) whereas, the minimum weight per fruit (168.12 g), yield per plant (29.70 kg) and yield per hectare (82.57 q) noticed under P1 X Zn1 (P2O5 300 g/ plant & ZnSO4 @ 0.25 %).

Quality characters

The chemical parameters of guava fruits were not significantly improved by the combined application of phosphorus and
zinc sulphate over the lower concentrations. The maximum TSS (11.11 °Brix) was found in treatment combination P₄ X Zn₃ (P₂O₅ 600 g/ plant & ZnSO₄ @ 0.75 %) and minimum (8.50 °Brix) was found in P₁ X Zn₁ (P₂O₅ 300 g/ plant & ZnSO₄ @ 0.25 %). The maximum titrable acidity (0.70) was found in treatment P₁ X Zn₂ (P₂O₅ 300 g/ plant & ZnSO₄ @ 0.50 %) and P₂ X Zn₂ (P₂O₅ 400 g/ plant & ZnSO₄ @ 0.50 %) whereas the minimum (0.67 %) was in P₁ X Zn₃, P₄ X Zn₂ and P₄ X Zn₃. The increase in T.S.S. under the influence of micronutrients might be due to hydrolysis of complex polysaccharides into simple sugars, synthesis of metabolites and rapid translocation of photosynthetic products and minerals from other parts of plant to developing fruits. Several workers observed similar results as, Ghosh (1986), Balakrishnan (2000) and Balakrishnan (2001) in guava.

It is concluded that soil application of phosphorus and foliar spray of zinc sulphate and their interaction had significantly improved the Yield and chemical parameters of guava. Individual spray of phosphorus i.e. P₄ (P₂O₅ 600 g/ plant) followed by P₃ (P₂O₅ 500 g/ plant), and individual spray of zinc sulphate i.e. Zn₃ (ZnSO₄ @ 0.75 %) followed by Zn₂ (ZnSO₄ @ 0.50 %) were found to be the best treatments for almost yield and quality parameters of guava plant. In the interaction effect of phosphorus and zinc sulphate, the treatment P₄ X Zn₃ (P₂O₅ 600 g/ plant & ZnSO₄ @ 0.75 %) followed by P₃ X Zn₃ (P₂O₅ 500 g/ plant & ZnSO₄ @ 0.75 %) were found to be the best treatments for almost yield and quality parameters of guava plant.

References


Singh, P.N., and Chhonkar, V.S. 1983. Effect of zinc, boron and molybdenum as foliar spray on chemical composition of guava fruit. Punjab J. Hort. 23:
